

counts for no trace of it being found, though the wave coming from the eastward on the morning of that day, just before the cyclone had arrived, No. VII., was discernible.

"There is no definite statement, so far as I am informed at present, of the true time of any particularly severe shock or explosion at Krakatoa excepting that which is contained in the letter of Mr. Watson (published in *NATURE*, December 6, 1883), whose ship was within a few miles of the volcano on the morning of August 27. He refers to an unusually severe explosion as having occurred at 11h. 15m. a.m. local time, which is nearly 45 minutes later than the time, 9h. 32m., arrived at in the foregoing discussion. The point of the disturbance (as indicated by the barograms) which has been taken as the front of the wave is the highest point of the first abrupt rise of the trace, and is perhaps, on an average, not far from one hour after the first signs of disturbance, the increase of pressure having been very rapid during the interval, but broken into two or three steps or oscillations. During the following half hour there is usually a large decrease of pressure, succeeded by another abrupt rise lasting about half an hour. Then follow a fall of about an hour, then a rise of an hour and a half, and then a fall of an hour and a quarter. The whole length of the disturbance on the time scale is between five and six hours, corresponding to an actual distance of between 3500 miles and 4000 miles. The length of the first main wave of the disturbance is about one hour on the time scale, or about 700 miles in length over the earth's surface.

"In the present position of our knowledge of the facts, it can only be surmised that the shock of 11h. 15m. a.m. of August 27, observed by Mr. Watson, corresponds to the second main feature of the disturbance. That the wave which forms the first feature would have originated at 11h. 15m. a.m. is apparently inconsistent with the observed velocities, which it has been shown are remarkably consistent, and indicate without much doubt an origin at 9h. 32m. a.m.

"The barometric disturbance at Mauritius noted by Dr. Meldrum is said to have begun soon after 11 a.m. local time. The distance from the volcano to Mauritius being about 3450 miles, the wave at the rate of 674 miles per hour would have reached the island in 5h. 7m. Taking the great shock at 2h. 32m. Greenwich mean time, as before reckoned, the wave would reach Mauritius at 7h. 39m. Greenwich mean time, or adding the allowance for difference of longitude, 3h. 50m., the local time would be 11h. 29m., which agrees satisfactorily with the facts as recorded.

"In conclusion, it may be noticed that the sea-waves produced by this volcanic disturbance, assuming the time of its occurrence to have been 2h. 32m. Greenwich mean time on August 27, were propagated with an approximate velocity of 480 miles an hour to Mauritius, of 430 miles an hour to Port Elizabeth near the Cape of Good Hope, and 420 miles to Galle, and a somewhat slower rate to Aden. The details of the occurrence of these waves on the coasts of India will shortly be laid before the Society by Major Baird, who has informed me that the velocity of the wave between Galle and Aden was 378 miles an hour, and the lengths of the great waves from 287 to 630 miles."

"P.S.—December 15. Since the above was read before the Royal Society a copy of the barometric trace from New York has been received, which shows disturbances very similar to those recorded at Toronto, and at times which are quite in accordance with the general conclusions stated in the paper."

NOTES

IN connection with the resignation of Prof. Sylvester of his Chair in the Johns Hopkins University, we find that it was resolved at a meeting of the trustees held October 1, "That as this resignation is doubtless the result of mature reflection on the part of Prof. Sylvester, it is hereby accepted, but that in doing so the Board of Trustees cordially extend to him its hearty thanks for the invaluable services which he has rendered to the University, and also its profound sense of the great ability, the conscientious fidelity, and untiring energy with which he has discharged the arduous duties of his Chair, thereby elevating the science of mathematics to its proper plane, not only in this institution but in this country." It was also resolved

"That Prof. Sylvester be appointed Professor Emeritus in the Johns Hopkins University."

It may be remembered that at the recent Geodetic Congress the French delegates opposed the adoption of Greenwich as the universal meridian, though M. Faye was in favour of the adoption of Greenwich time. At the meeting of the Paris Academy on December 3, M. Faye, whilst supporting the proposal that the universal time should be that of Greenwich, stipulates for the civil hour instead of the astronomical hour, and for the counting of longitudes from 0h. to 12h. positive towards the east and negative towards the west, instead of from 0h. to 24h. reckoned towards the east, but leaving it to astronomers and navigators to employ at discretion for the universal time that according to civil or astronomical reckoning, as may seem best.

A MEETING was held in Sheffield last week for the purpose of carrying out, in connection with Firth College, a proposed technical department having reference to the trade of the district. Among those who spoke were Mr. Mundella and Dr. Sorby, and we need not say that all agreed as to the desirability of establishing such a department, and the necessity of educating our captains, as well as our privates, of industry, in the principles of their crafts. For that, Mr. Mundella insisted, is the true technical education. He gave the experience of a friend who has just been visiting the United States, and inspected the means for technical education existing there; the distinct conclusion was "that there is more skill and intelligence in American industrial pursuits than there is in our English industrial pursuits." It is much that we know our weakness and are taking means to remedy it. No doubt the Firth College will soon have a well equipped technical department.

THE Lecture Arrangements at the Royal Institution before Easter, 1884, are as follows:—Prof. Dewar, six lectures (adapted to a juvenile auditory) on Alchemy (in relation to modern science), commencing on Thursday next (December 27); Mr. R. S. Poole, two lectures on the Interest and Usefulness of the Study of Coins and Medals; Mr. A. Geikie, five lectures on the Origin of the Scenery of the British Isles; Prof. J. G. McKendrick, five lectures on Animal Heat: its Origin, Distribution, and Regulation; Prof. Ernst Pauer, six lectures on the History and Development of the Music for the Piano-forte, and its Predecessors the Clavichord, Harpsichord, &c.; Prof. Tyndall, six lectures on the Older Electricity, its Phenomena and Investigators; Prof. Henry Morley, six lectures on Life and Literature under Charles I.; and Capt. Abney, six lectures on Photographic Action, considered as the Work of Radiation. The Friday Evening Meetings begin on January 18, Prof. Tyndall on Rainbows. The discourses on the other evenings will probably be as follows:—Rev. T. G. Bonney, the Building of the Alps; Prof. Ma Müller, Rājāh Rāmmohun Roy; Mr. G. J. Romanes, the Darwinian Theory of Instinct; Prof. Thorpe, the Chemical Work of Wöhler; Sir Frederick Bramwell, London (below bridge) North and South Communication; Prof. Hughes, Theory of Magnetism (illustrated by experiments); Mr. C. V. Boys, Bicycles and Tricycles in Theory and Practice; Mr. J. N. Langley, the Physiological Aspect of Mesmerism; Mr. Walter Besant, the Art of Fiction; Prof. O. Reynolds, the Two Manners of Motion of Water (shown by experiments).

EVERY one must wish well to the scheme for an Institute for East London, to the meeting in connection with which last Friday at the Mansion House the President of the Royal Society gave the benefit of his experience as an East End doctor forty years ago. The demand for such commodities as the Institute would furnish is strong enough; eminent men of science who have lectured in Whitechapel on their special subjects tell us

that the largest obtainable place of meeting in the district is invariably crowded.

A MEETING and *conversazione* will be held under the auspices of the National Association of Science and Art Teachers, in the Manchester Technical School and Mechanics' Institution on Saturday, December 22. Prof. Roscoe, F.R.S., will take the chair. It is expected that a large number of science and art teachers will be present, including visitors and delegates from the Liverpool, Birmingham, and Newcastle-upon-Tyne branches of the Association. It has been arranged on this occasion to bring together for exhibition a collection of apparatus, models, text-books, diagrams, and appliances of a new and interesting nature bearing upon the study of science and art. We have no doubt the meeting will be a successful one. The Association is calculated to be of great service to science teachers, and deserves encouragement. Prof. Huxley is president, and the secretary is Mr. W. E. Crowther, Technical School, Manchester.

AT the last meeting of Superintendents of National Education at Washington, Prof. Bickmore described the lectures on natural history which he now gives every Saturday to school teachers, and the first history of these lectures. The authorities of the Natural History Museum wrote to the Board of Education in New York suggesting that a select few of their teachers should come to hear an informal address upon the objects there exhibited. Sets of these lectures were attended first by those few, then by fifty, then by over one hundred teachers. They are now given to a full hall every Saturday. No continued systematic series of illustrations could be met with, so a photographer was employed to take transparencies of specimens and copies of various illustrations bearing upon the subject to be exhibited by the oxy-hydrogen light. Another lantern is also used to throw light upon the written lists and diagrams or upon objects which are arranged in pigeon-holes, upon each one of which exactly the lecturer can throw the light as it is wanted.

AFTER some interesting reflections upon the wonderful strides in population revealed by the last United States census, Dr. Harris pointed out to the same meeting how partial would be the value of any special technical education that might be given to a whole school. He urged that mechanical inventions were every day throwing out of work "hands" that had acquired manual dexterity. Education of the brain to directive intelligence is the great want. The large development of invention is set down to the study of natural science and of the phenomena of physical processes. On the other hand, the relish, by many students at least, for manual instruction leads the authorities at Boston to report that "manual training is so great a relief to the iteration of school work that it is a positive benefit rather than a detriment to the course in the other studies."

WE learn from Trondhjem that the starling has been seen for the last two winters in the north of the Trondhjem Amt, sitting on the roofs of houses at Christmas time, notwithstanding the cold, which was considerable for the season. In the present year some of the birds are again to be seen after their usual period of migration.

Naturen reports that Prof. Heiberg of Christiania has demonstrated the presence in the air passages and pulmonary substance of hares of a form of strongylus, both barren and charged with ova, which would appear to be the cause of an otherwise unexplained mortality among these animals in the autumn of last year in the district of Eidsvold in Norway.

SEVERAL Russian writers have of late been drawing attention to the fact that the Japanese seas harbour various species of fish which are poisonous. Dr. Sawtscherks even suggests that ships going to these waters ought to be provided with descriptions and

representations of these suspected fish, of which twelve varieties would appear to belong to Tetradon, *T. inermis*, the Japanese "Kanatuka," being reported as especially venomous. According to Dr. Guldrew, one Japanese fish, known as Fuku, is so poisonous that death follows almost instantaneously after eating only a moderate-sized bit of the flesh. The Japanese are forbidden by law to eat this fish, but it is nevertheless not unfrequently the cause of death among the lower classes, who believe it to be possessed of certain marvellous properties, on account of which they risk the danger of being poisoned.

IT is evident that we have much yet to learn respecting insects which habitually go through their early stages in *sea water*. In the current number of the *American Naturalist* (December, 1883) is an account by A. W. Pearson of the larva of the Dipterous family *Stratiomyidae* that was found by him beneath *Zostera* on the beach near the mouth of the Merrimac River. With a few exceptions all marine insects are either Coleopterous or Dipterous, and it is the latter order especially that shows itself the most diversified in point of larval adaptation to extraordinary conditions.

M. TILLO publishes in the last number of the *Izvestia* of the Russian Geographical Society the results of very accurate measurements he has made of the lengths of the rivers of Russia in Europe. The measurements have been made on the ten-versts-to-an-inch map of Russia, and present great differences with those which were published by General Strelbitsky in his work, "Superficie de l'Europe;" these last have been made on a map of a much smaller scale (sixty versts to an inch), and contain several errors. The figures of M. Tillo are, on the average, by 26 per cent. greater than those of M. Strelbitsky, showing thus the error which may ensue from measurements made on smaller maps; several rivers, as the Kama, Dnieper, Dniester, and Oka, are, in M. Strelbitsky's measurements, respectively by 200, 285, 300, and 315 versts too short; whilst the ten versts' map has given to M. Tillo a length of the Dnieper only by one-twentieth shorter than the three-versts-to-an-inch map. The chief rivers of Russia appear now with the following lengths: Volga, 2108 miles (the verst being taken equal to 0.663 miles), Ural, 1480 miles; Dnieper, 1329; Don, 1124; Kama, 1117; Petchora, 1024; and Oka, 915 miles.

IN the same periodical, M. Woeikof points out that the tea tree and the bamboo could be advantageously cultivated in Russian Transcaucasia. The most northern point where he has seen the tea tree in Japan is Akita, close by the western shore of Nippon, under 39° 45' N. lat.; and he has been told that it is grown even at the frontier of Amovori, under the fortieth degree of latitude. The average temperature at Akita would be, according to meteorological observations at Niigata and Hakodate, about 11°·5 Cels. for the year, zero in January, 23°·5 in July, and 24°·5 in August. The tea tree grows very well also in the valleys at Ponevara, under 38° N. lat., 900 feet above the sea-level, where the average yearly temperature is no more than 12°, and that of January no more than 0°, whilst every year there falls a deep snow. As to the bamboo tree, it is cultivated under 39° 10', 500 feet above the sea-level, on the western slope; and under 38° 35', 400 to 450 feet above the sea-level, on the eastern slope. In the western parts of Transcaucasia, between Batoum and Tuapse, the average yearly temperature varies from 13° to 15°, and that of January is between 4°·5 to 6°·5. Both are thus higher than those of Japan. The summer is, perhaps, a little colder, but this difference would hardly exercise any influence. Even in the interior of the country, up to the Great Caucasus ridge, and east to that of Meakhi, the average temperatures at places up to 1000 feet above the sea-level would allow the culture of the tea tree. As to the rains, they are quite

sufficient in Western Transcausia, whilst in the eastern parts of the country irrigation would be necessary.

L'Astronomie states in its last number, in reference to a recent note in NATURE, that Admiral Mouchez has drawn up a memorial praying for the removal of the Paris Observatory from its present position, but that he has not yet presented it to the Council of the Observatory, but will do so at an early period. It is not the first time that the idea has been started. The proposal was made in 1868, and a Commission appointed to report on the matter. The scheme was objected to strongly by Leverrier, and finally rejected after a very sharp discussion.

THE SWEDISH frigate *Vanadis* has just started on a cruise round the world. King Oscar's second son participates in the cruise, as well as Dr. Hjalman Stolpe, who has been commissioned by the Government to collect materials for the nucleus of a National Ethnographical Museum in Stockholm. The frigate, whose mission is chiefly scientific, will call at many places of interest, as, for instance, the Straits of Magellan, the Marquesas and Sandwich Islands, the remarkable Malden Island, &c. A Swedish merchant, M. Fürstenberg of Gothenburg, has contributed 600*l.* for the purchase of objects of scientific value.

M. BOURDALOU, having published in 1864, in his work, "Nivellement Général de la France," that the average level of the Mediterranean is by 0.72 metres lower than that of the Atlantic, this result was received with some distrust by geodesists. General Tillo points out now, in the last issue of the Russian *Izvestia*, that this conclusion is fully supported by the results of the most accurate levellings made in Germany, Austria, Switzerland, and Spain, which have been published this year. It appears from a careful comparison of the mareographs at Santander and Alicante by General Ibanez, that the difference of levels at these two places reaches 0.66 metre, and the differences of level at Marseilles and Amsterdam appear to be 0.80 metre when compared through Alsace and Switzerland; the *Comptes Rendus de la Commission Permanente de l'Association Géodésique Internationale* arrive at 0.757 metre from the comparison with the Prussian levellings, whilst the fifth volume of the "Nivellements der Trigonometrischen Abtheilung der Landesaufnahme" gives 0.809 *viâ* Alsace, and 0.832 *viâ* Switzerland. The difference of levels at Trieste and Amsterdam, measured *viâ* Silesia and Bavaria, appears to be 0.59 metre. Each of these four results (0.72, 0.66, 0.80, and 0.59), having a probable error of 0.1 metre, their accordance is quite satisfactory, and we may admit thus that the average level of the Mediterranean is in fact lower by 0.7 metre than that of the Atlantic.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus* δ) from India, presented by Mr. J. L. Waldon; a Night Heron (*Nycticorax griseus*), European, presented by Mr. N. H. Fenner; two Barbary Turtle Doves (*Turtur risorius*) from North Africa, presented by Miss Stewart; four King-hals Snakes (*Sepeidon hamachetes*), a Hoary Snake (*Coronella cana*) from South Africa, presented by the Rev. G. H. R. Fisk, C.M.Z.S.; a Black-faced Kangaroo (*Macropus melanops* δ) from Australia, a Broad-nosed Lemur (*Haplorhina sinuatus* δ) from Madagascar, an Exanthematic Monitor (*Varanus exanthematicus*) from West Africa, purchased.

OUR ASTRONOMICAL COLUMN

THE MASS OF SATURN.—Prof. Asaph Hall has communicated to the Royal Astronomical Society a note upon the mass of Saturn deduced from observations of the outer satellite *Japetus*, made with the 26-inch refractor at the Naval Observatory, Washington, in 1875, 1876, and 1877. The mean distance of the satellite from its primary, reduced to the mean distance of the latter (9.53885), was found to be 515".522 from 128 observations. For the periodic time of *Japetus* Prof. Hall compared

his own observations with one by Sir W. Herschel on Sept. 20, 1789, and with Sir John Herschel's observations made at the Cape of Good Hope in 1837. The resulting sidereal revolution is 79.3310152 days. Hence the mass of Saturn in units of the sun's mass is $\frac{1}{3482.2}$. Bessel, from heliometric measures of the

great satellite *Titan* obtained a value of $\frac{1}{3501.6}$, which has been since used in nearly all calculations where the mass of this planet enters; Jacob, from observations of *Titan* made at Madras in 1856–58, inferred a mass of $\frac{1}{3487.2}$, which it will be seen closely approaches that given by Prof. Hall. The value deduced by Leverrier from the theory of Uranus is $\frac{1}{3529.56}$, and therefore is the smallest of all.

CLOSE DOUBLE-STARS.—M. Perrotin has published in the *Astronomische Nachrichten* further measures of double-stars made at the Observatory of Montgros, Nice, amongst which are some of the close binaries. In July last he thought 72 Ophiuchi (rather a problematical object) might be elongated in the direction 110°, but in the following month it appeared single under good conditions of atmosphere. Of the closer stars we find—

			Position	Distance
η Coronæ Borealis ...	1883.564 ...	156°00 ...	0°610	
Σ 1938 595 ...	112°95 ...	0°750	
ϵ Equulei 640 ...	285°57 ...	0°973	
O. Σ . 395 667 ...	95°30 ...	0°690	

PONS' COMET.—The following approximate places of Pons' comet are deduced from the provisionally corrected elements of MM. Schulhof and Bossert:—

At Greenwich Midnight						
1883-4	R.A.	Decl.	Log. distance from Earth	Log. distance from Sun		
	h. m. s.					
Dec. 31 ...	21 39 4 ...	+ 23 54'9 ...	9.8263 ...	9.9585		
Jan. 2 ...	21 53 26 ...	20 45'2 ...				
4 ...	22 7 37 ...	17 22'8 ...	9.8098 ...	9.9409		
6 ...	22 21 31 ...	13 49'5 ...				
8 ...	22 35 3 ...	10 7'5 ...	9.8029 ...	9.9249		
10 ...	22 48 9 ...	6 21'0 ...				
12 ...	23 0 44 ...	+ 2 33'2 ...	9.8065 ...	9.9111		
14 ...	23 12 45 ...	- 1 12'2 ...				
16 ...	23 24 10 ...	4 52'7 ...	9.8201 ...	9.9002		
18 ...	23 34 58 ...	8 24'9 ...				
20 ...	23 45 8 ...	11 47'7 ...	9.8414 ...	9.8928		
22 ...	23 54 41 ...	14 59'5 ...				
24 ...	0 3 37 ...	17 59'9 ...	9.8678 ...	9.8894		
26 ...	0 11 57 ...	20 48'2 ...				
28 ...	0 19 44 ...	- 23 25'1 ...	9.8966 ...	9.8901		

The intensity of light is at a maximum in the middle of January. The comet will be nearest to the earth on January 9, distance 0.634, or rather less than two-thirds of the earth's mean distance from the sun. At its last appearance in 1812 it did not approach the earth within about 1.35.

TEMPEL'S COMET, 1867 II.—M. Raoul Gautier of Geneva is engaged upon a revision of the orbit of this comet, which, it may be remembered, experienced great perturbations from a near approach to the planet Jupiter during the revolution 1867–73. It may probably arrive at perihelion again about May, 1885. If there should still be unpublished observations of this comet, it would be desirable to communicate them at once to M. Gautier, that they may be brought to bear upon his investigation.

DE MORGAN'S FIVE FIGURE LOGARITHMS.—There is a report that the five-figure tables of logarithms of numbers and trigonometrical functions published "under the superintendence of the Society for the Diffusion of Useful Knowledge," but which are usually known as De Morgan's Tables, are out of print, and that there is no present intention of a further issue. If this be the fact, it is much to be regretted: they are by far the most convenient five-figure tables that we possess, on the score of size and legibility, and have been widely utilised in astronomical calculations. Lalande's Tables, the stereotype edition of Firmin Didot, are good, and the same may be said of Gauss's, where it is of advantage to have two degrees on one opening; but we nevertheless unhesitatingly give the preference to "De Morgan."